

**VERTICILLIUM WILT (RACE 2) OF TOMATO**

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Verticillium wilt of tomato is caused by the soil-borne fungus Verticillium albo-atrum Reinke & Berth. The pathogen has been reported on more than 200 plant species including trees, ornamentals, fruits, vegetables, field crops, and weeds (3). Among vegetables it is most common on tomato, potato, eggplant, and okra. Although the fungus is widely distributed in soils in the temperate and adjoining subtropical zones, Verticillium wilt of tomato remains of minor consequence in the United States except in California, Utah, North Carolina, and Dade County, Florida (3, 8, 11).

Race 1 is the common physiological form of V. albo-atrum on tomato. However, it causes little or no economic losses because nearly all current fresh market varieties contain the Ve gene for resistance to race 1. A second physiological form (race 2) recently was found at the Gulf Coast Research and Education Center in the middle of the Manatee-Ruskin tomato growing area (6). This new race has not been found in any other location in Florida, but it has been reported in California (4), Ohio (1), and North Carolina (2). No commercial varieties are resistant to race 2, although potential sources of resistance have been developed in North Carolina (9) and France (J. W. Scott, personal communication).



**Fig. 1.** Chlorosis of tomato seedling infected with Verticillium albo-atrum Race 2.



**Fig. 2.** Intial symptoms on field plants: wilting with little or no yellowing of the affected leaves.



**Fig. 3.** Mature tomato plants with typical Verticillium wilt symptoms of wilting and chlorosis.



**Fig. 4.** Close-up of interveinal chlorosis and fan-shaped necrotic lesions.

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Verticillium albo-atrum is a soil inhabitant and can survive indefinitely in the soil (11). Infection almost always originates from inoculum in the soil, although tomato leaves sometimes are infected by aerial spores of the fungus (8). Dissemination of the fungus occurs primarily by movement of infested soil clinging to tomato stakes, workers, tools, machinery, trucks and cars or by the water movement of infested soil (8). Seed may be infected, but this phase of transmission is unimportant (11).

Verticillium wilt of tomato is favored by alkaline soils, the use of nitrate-nitrogen fertilizer, and by high soil moisture (3). The optimum temperature for disease development is variable, with an average optimum of 76° F in the temperate zones. However, in subtropical Florida the disease is inhibited by cool soils and is favored by a combination of high temperature (82°-84° F) and a short day (7).

**SYMPTOMS.** Verticillium-infected tomato seedlings display chlorosis of lower leaves (Fig. 1.) The first apparent field symptoms generally do not occur until the beginning of fruit set, and consist of the diurnal wilting and recovery of the lower leaves (Fig. 2.). Initially the leaves are green, but yellow areas develop along the margins or interveinally. Fan-shaped necrotic lesions develop as the yellowing progresses, and the affected leaves gradually wither (Figs. 3 and 4). Diseased plants, although not killed by the fungus, are stunted, do not respond to fertilizer, and produce small fruit. Fruit yield may be reduced 30% to 60% (5), and fruit quality is poor. However, yield reductions may be negligible when weather and soil conditions are favorable for the crop.

A lengthwise cut of an infected plant near the base sometimes reveals a light tan discoloration of the vascular tissue. In Florida, the discoloration typically is much lighter than that of Fusarium wilt and usually does not extend far up the stem before fruit are mature. There is no decay of the pith typical of southern bacterial wilt, nor dark brown vascular bundles at the base of the petiole typical of Fusarium wilt (8).

**CONTROL.** Use resistant tomato varieties for the control of the common race 1. Exclusion, sanitation, solarization, and fumigation must be employed to control race 2 since no resistant commercial varieties presently are available. The prevention of movement of pathogen-infested soil into noninfested areas is an excellent control method. Solarization in Florida has greatly reduced disease severity (10) and fumigation with a broad-spectrum fumigant also has greatly inhibited disease development in recently infested soils (6).

**SURVEY AND DETECTION.** Examine plants from the time of blooming to fruit maturation. Diurnal wilting and recovery of the foliage, the development of fan-shaped necrotic areas along the margins of the leaflets, perhaps light tan but not dark colored vascular tissue, and absence of pith decay are characteristic symptoms of Verticillium wilt of tomato.

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